1730-4 MEASUREMENT AND PAYMENT

Communications Cable (____*-Fiber*) will be measured and paid as the actual linear feet of fiber-optic cable of each fiber count furnished, installed and accepted. Measurement will be made by calculating the difference in length markings located on outer jacket from start of run to end of run for each run. Terminate all fibers before determining length of cable run.

Drop Cable will be measured and paid as linear feet of fiber-optic drop cable assemblies furnished, installed and accepted. Sag and vertical segments will not be paid as these distances are incidental to the installation of drop cable assemblies.

No measurement will be made for terminating, splicing and testing fiber-optic cable, communications cable identification markers or fiber-optic cable storage racks, as these will be incidental to the installation of fiber-optic cable.

Payment will be made under:

Pay Item	Pay Unit
Communications Cable (____-Fiber)	Linear Foot
Drop Cable	Linear Foot

SECTION 1731
FIBER-OPTIC SPLICE CENTERS

1731-1 DESCRIPTION

Furnish and install fiber-optic interconnect centers, fiber-optic splice enclosures and all necessary hardware.

Modify existing fiber optic interconnect centers and/or splice enclosures as shown in the plans. Refer to manufacturer's recommendations for opening, modifying and re-sealing the existing fiber optic interconnect center and/or fiber optic splice enclosures.

1731-2 MATERIALS

Refer to Division 10.

Item	Section
Fiber-Optic Splice Centers	1098-11

Furnish material, equipment and hardware under this section that is pre-approved on the ITS and Signals QPL.

1731-3 CONSTRUCTION METHODS

(A) General

Include on the cover of each slice tray in a legible format the following information:

(1) Splice location reference number or identification information (i.e. 06-1011 tray 1 of 3, 06-1011 tray 2 of 3, etc.)

(2) Date the splice was made

(3) Company name of individual performing the splicing

(4) Name of individual performing the splicing

(B) Workmanship

Upon cutting the cable and removing the outer jacketing material down to the individual buffer tubes, secure the central strength member to the enclosure so that no tensile force is applied to the fibers. Secure the individual buffer tubes to the splice trays by a method recommend by the manufacturer. Determine the length of each buffer tube needed to ensure the buffer tube can be looped a minimum of two times around the inside the splice tray. Upon determining the length of buffer tube needed remove the buffer tube to expose the individual fibers for fusion splicing. Adjust individual fiber lengths as necessary to ensure that once the fusion splicing process is completed that the finished splices will align with the "splice block organizer" supplied within the splice tray. Ensure the slice block organizer has individual fusion splice space holders for each fiber splice.

While prepping the individual fibers for splicing install the heat shrink protecting tube over the fiber and then perform the splicing operations, following the manufacturer's instructions. Verify the newly formed splice does not exceed 0.05 dB of attenuation. If the attenuation is more than 0.05 dB then remake the splice until it meets the 0.05 dB or less requirement. Finish the splicing operation by sliding the heat shrink tube over the splice and applying heat to activate the heat shrink tubing. Secure the finished splice in the splice block organizer. Ensure each splice is properly secured in a space holder in the splice block organizer. Multiple splices secured to the same space holder are unacceptable.

Ensure all buffer tubes are contained within splice trays so no bare fibers are outside tray and do not damage the fiber or violate the minimum bending radius of the fiber.

Prior to installing the cover over the splice tray and placing it in its final resting location, take a MANDATORY digital photograph of the splice tray that shows the final workmanship. Ensure the photograph shows the "Workmanship Identification Information" as well as the workmanship associated with installing and terminating the fiber. Include digital copies of each photograph on a compact disk as part of the OTDR Test Results submittal.

(C) Termination and Splicing within Interconnect Center

Install interconnect centers with connector panels, splice trays, storage for slack cable or fibers, mounting and strain relief hardware and all necessary hardware.

Terminate and splice all fibers including unused fibers.

Label all fiber-optic connectors, whether on jumpers, connector panels or other equipment, to prevent improper connection. Obtain approval of fiber-optic connector labeling method.

For all fibers designated for termination to connector panel within interconnect center, fusion splice fibers to pigtails.

For all cut fibers designated to pass through interconnect center, fusion splice fibers.

For all buffer tubes designated to pass through interconnect center, neatly coil excess tubing inside interconnect center.

(D) Termination and Splicing within Interconnect Center

Terminate and splice all fibers including unused fibers.

Label all fiber-optic connectors, whether on jumpers, connector panels or other equipment, to prevent improper connection. Obtain approval of fiber-optic connector labeling method.

For all fibers designated for termination to connector panel within interconnect center, fusion splice fibers to pigtails.

For all cut fibers designated to pass through interconnect center, fusion splice fibers.

For all buffer tubes designated to pass through interconnect center, neatly coil excess tubing inside interconnect center.

(E) Termination and Splicing within Splice Enclosure

Install splice enclosures with splice trays, basket containment assemblies, racking for slack cable or fibers, mounting and strain relief hardware, and all other necessary hardware.

Fusion splice all fibers including fibers designated to be coupled with fibers from a drop cable assembly and cut fibers designated to pass through splice enclosure.

For all buffer tubes designated to pass through splice enclosure, neatly coil excess tubing inside basket provided with enclosure.

Label all fiber-optic splices. Obtain approval of fiber-optic connector labeling method.

Install heat shrink cable shields using methods recommended by the manufacturer of the enclosure. Perform a pressurization flash test on enclosure in accordance with manufacturer's recommended procedures at the conclusion of splicing procedure and before final placement of enclosure.

For aerial installations, secure enclosures to messenger cable using manufacturer supplied hardware. Secure SMFO cable and drop cable assemblies to snowshoes.

Install enclosures with enough slack cable to allow enclosure to be lowered to ground level and extended into a splicing vehicle.

For underground, manhole, and junction box facility installations, place the enclosure along with required spare cables in the facility in a neat and workmanship like manner.

(F) Modify Interconnect Center and Splice Enclosure

Modify existing fiber optic interconnect centers and/or splice enclosures as shown in the plans. Install additional patch panels, splice trays and pigtails where necessary and fusion splice fiber connections and perform OTDR testing as required by the plans. Install new fiber optic jumpers and make connections to equipment and/or patch panels as necessary.

(G) Testing

Provide written notification a minimum of 10 days before beginning OTDR tests.

After splicing is completed, perform bi-directional OTDR tests on each fiber, including unused fibers. Install a 1,000-ft pre-tested launch cable between the OTDR and fiber optic cable to be tested and a 1,000-ft pre-tested destination cable on the end of the fiber optic cable to be tested. Ensure each launch cable has been tested and is compatible with the fiber being installed. Provide Engineer with test results of the launch cable before use. Re-test or replace launch cable at Engineer's request.

Ensure fusion splice losses do not exceed 0.05 dB and connectors have a loss of 0.5 dB or less. If any fiber exceeds maximum allowable attenuation or if fiber properties of the cable have been impaired, take appropriate actions up to and including replacement of the fiber cable.

Clearly label each OTDR trace identifying a starting and ending point for all fibers being tested. Record the attenuation level of each fiber and clearly indicate OTDR trace results in report format. Furnish 2 hard copies of each of the OTDR trace results and electronic copies of all trace results along with digital photographs showing workmanship for each splice on a compact disk. Furnish the manufacturer's make, model number and software version of the OTDR used for testing.

Furnish to the Engineer 2 copies of the software needed to view the OTDR traces electronically.

1731-4 MEASUREMENT AND PAYMENT

Interconnect Center will be measured and paid as the actual number of fiber-optic interconnect centers furnished, installed and accepted.

Splice Enclosure will be measured and paid as the actual number of fiber-optic splice enclosures furnished, installed and accepted. No measurement will be made between aerial, underground, manhole or junction box installation of the fiber-optic splice enclosure.

Modifying Splice Enclosure will be measured and paid as the actual number of fiber-optic splice enclosures modified and accepted. No measurement will be made between aerial, underground, manhole or junction box installation of the fiber-optic splice enclosure.

No measurement will be made of splice trays, pigtails, jumpers, connector panels, testing and any corrective actions, repairs and replacements needed for exceeding maximum allowable attenuation or other defects, as these will be incidental to furnishing and installing fiber-optic interconnect centers and splice enclosures and modifying splice enclosures.

Payment will be made under:

Pay Item	Pay Unit
Interconnect Center	Each
Splice Enclosure	Each
Modifying Splice Enclosure	Each

SECTION 1732
FIBER-OPTIC TRANSCEIVERS

1732-1 DESCRIPTION

Furnish and install fiber-optic transceivers with all necessary hardware.

1732-2 MATERIALS

Refer to Division 10.

Item	Section
Fiber-Optic Transceivers	1098-12

Furnish material, equipment and hardware under this section that is pre-approved on the ITS and Signals QPL.

1732-3 CONSTRUCTION METHODS

Install fiber-optic transceivers in each equipment cabinet and comply with manufacturer's installation instructions.

1732-4 MEASUREMENT AND PAYMENT

Fiber-Optic Transceiver - Drop and Repeat will be measured and paid as the actual number fiber-optic drop and repeat transceivers furnished, installed and accepted.

Fiber-Optic Transceiver - Self-Healing Ring will be measured and paid as the actual number of fiber-optic self-healing ring transceivers furnished, installed and accepted.